Quincke: Zur Pathologie der Harnorgane, Deutsch. Arch. f. klin. Med., 1904, lxxix, 290-305.

Rothschild: Beitrag zur Kenntniss gerinnselartiger Gebilde im Urin, Deutsch. med. Wchnschr., 1901, xxvii, 873-876.

Senator: Ueber die im Harn vorkommenden Eiweisskörper und die Bedingungen ihres Auftretens bei den verschiedenen Nierenkrankheiten, über Harncylinder und Fibrinausschwitzung, Virchows Arch. f. path. Anat., 1874, lxx, 490.

Suter: Handbuch der inneren Medizin, Berlin, 1912, p. 44.

Trischitta: Un caso di fibrinuria, Clin. med. ital., Milano, 1900, xxxix, 525-532.

Von Jaksch: Zur Kenntniss der Ausscheidung mucinartiger und fibrinartiger geformter Massen aus dem uropoëtischen System, Ztschr. f. klin. Med., 1893, xxii, 551.

ANTHRAX FROM THE SHAVING-BRUSH AND PRIMARY ANTHRAX MENINGITIS.

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Soon after the beginning of the War, numerous cases of anthrax were reported in which the source of the infection was obscure. The first cases were reported in England in 1914 from among the troops in the concentration camps. No history could be obtained of any contact with cattle, hides, meat or wool, nor of any of the known sources of anthrax infection. In nearly every instance the disease made its appearance on the face as a malignant pustule. Later when the United States entered the War anthrax infection made its appearance among our troops in the training camps, although a few scattered cases occurred among civilians.

A typical instance of shaving-brush infection came under the writer's observation and will be introduced at this point in order to include it in a general summary of the subject that is to follow.

M. B., male, aged thirty-four years, a window-washer by occupation, complained of a sore on the right side of the neck, slightly below the angle of the jaw. Four days before, as he was about to shave, he noticed a small pimple on the neck. He had just bought a new shaving-brush for ten cents and was about to use it for the first time. While he was shaving he cut off the top of the pimple and it bled a little. This spot became sore shortly afterward and developed into a pustule, which quickly grew larger and the neck began to swell. He felt apprehensive and could not sleep well. When first examined the sore measured 2 cm. in diameter. It was indurated and raised somewhat above the level of the surrounding skin. In the center was a black eschar surrounded by vesicles, some 0.5 cm. in diameter, which contained a slightly bloody serum. The skin surrounding this for a distance of 2 or 3 cm. was very red and edematous. The lymphatic glands under the jaw were swollen and indurated. The temperature was 100° and the pulse 96. The leukocytes were 17,000. A blood culture made the following day developed no growth.

Smears made from the serum in the vesicles contained many long bacilli, with square cut ends. A tendency to chain formation was noticeable. They were Gram-positive. Cultures were made on agar slants and bouillon, and from the latter agar plates were seeded. The colonies on the agar plates and slants developed in twenty-four hours typical medusa-head colonies and in the bouillon the growth formed long threads. The bacilli were non-motile. A small portion of the bouillon culture was introduced into the peritoneum of a guinea-pig. The animal died within twenty-four hours. The necropsy revealed an edema and erythema at the point of inoculation; the peritoneum was edematous and the spleen swollen. Smears and cultures taken from the point of inoculation, the spleen, peritoneal cavity and the heart blood contained bacilli which morphologically and culturally corresponded to anthrax bacillus.

As soon as the diagnosis was established the patient was referred to the surgical service. The affected area was excised completely, with a wide margin of healthy tissue, and the wound sutured without drainage. No local treatment was used and no serum given, as none could be obtained without considerable delay. The temperature and pulse-rate promptly dropped to normal and the wound healed *per primam*. The glandular swelling subsided rather slowly. At the end of one week the patient was discharged well.

An effort was made to cultivate anthrax bacilli from the shaving-brush. The bristles were placed in bouillon tubes and flasks and from these agar plates were seeded. The growth of contaminating organisms was so abundant and spread so rapidly over the plates that no anthrax colonies could be found. While the attempt to find the anthrax bacillus in the shaving-brush was unsuccessful, there can be little doubt that the infection originated from it. The patient's sole occupation was window-washing, and it did not bring him into contact with any of the common sources of anthrax infection, such as cattle, meat, wool or hides. The only possible carrier of anthrax was the shaving-brush, which he used for the first time the day before the sore began.

In the early reports of anthrax cases in England the infection of the shaving-brush was attributed to the "diabolical tactics of the enemy." The investigation made by Coutts[1] offered what appears to be the correct explanation. Before the War began the shaving-brush was made from badger-hair, horse-hair or pig bristles. Soon after War was declared badger-hair could not be used, as it had been imported chiefly from Russia. At the same time there developed a large demand for the shaving-brush by the troops in the training camps. To meet this demand manufacturers used horse-hair and pig bristles imported direct from China and Siberia. The former were notoriously dirty and were not properly disinfected. They were responsible for the most of the infections.[2]

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[1] Anthrax and the Shaving-brush, British Med. Jour., June 30, 1917, p. 882.

An investigation of the shaving-brush industry was also made in this country, but some time later, in which the infection was traced to both imported hair from China and Siberia and to "local hair" from the Argentine and Chicago. It was found that some manufacturers used the hair just as they received it, on the assumption that it had been disinfected, while others exposed the hair to prolonged boiling or to live steam, both of which seemed to yield satisfactory results. For general use, however, it was recommended that the hair be immersed for several hours in 10 per cent. formalin at a temperature of 110° F.

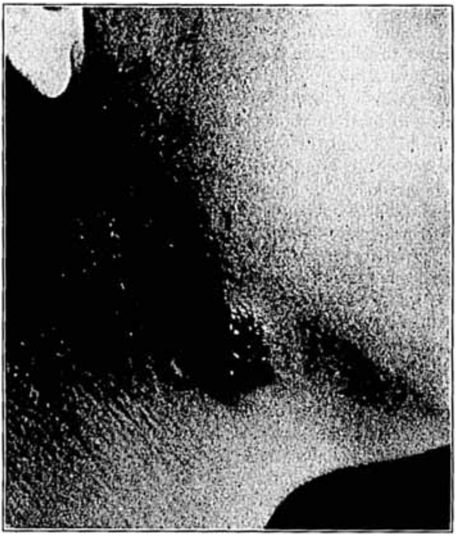

FIG. 1.—Malignant pustule on right side of neck caused by infected shaving-brush.

The investigation in England recorded 19 cases of anthrax among civilians from June, 1915, to October, 1916, 14 of which were proved to be caused by the shaving-brush and 5 suspected of starting in this way. In the army in France, from 1915 to February, 1917, 23 cases developed, all on the face and presumably from the use of the shaving-brush. No examination of the brushes could be made, however, because of the rapid movement of the troops in the field at this time. Among the troops in England there were 18 cases, 12 in the shaving area of the face and 4 almost certainly due to the shaving-brush.

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[2] Anthrax from the Shaving-brush, U. S. Public Health Reports, July 12, 1918.

In this country there have been 24 cases of anthrax caused by the infected shaving-brush. Two of these were civilians and the remainder among the troops in the training camps. In 6 of these the anthrax bacillus was cultivated from the brushes and the evidence in the other cases leaves little doubt that they were infected in the same way.

Numerous unsuccessful attempts were made to isolate the anthrax bacillus from the suspected brushes, due chiefly to the fact that cultural methods were used rather than animal inoculations. In the cultural method the enormous number of adventitious organisms on the brushes overgrows the anthrax spores, making it very difficult to identify the anthrax colonies.

Leake and Lederer[3] suggest the following method for isolating the anthrax bacillus from the shaving-brush:

One-half of the hair of the suspected shaving-brush is macerated in a mortar with 50 c.c. of normal salt solution. The suspension is pipetted off into large flasks or test-tubes and heated to 80° C. for ten to thirty minutes, in order to destroy the bacteria, leaving only the spores. The fluid is then centrifuged and the sediment used to inoculate mice and guinea-pigs. They advise using 0.5 to 1 c.c. for mice and 2 to 12 c.c. for guinea-pigs. A portion of the sediment may be used for culture purposes. They suggest that the sediment be diluted with salt solution, in order to obtain a good distribution of the colonies when agar plates are used. The colonies that appear suspicious are fished to agar slants and the growth developing on them is used to inoculate guinea-pigs and mice. With this method they were successful in isolating anthrax bacilli in three out of nine new shaving-brushes.

Clinically the cases presented the well-recognized types; the malignant pustule was the most frequent, as might be expected from the mode of transmission. Occasionally instances of septicemia and intestinal and pneumonic infection occurred. There were also 9 instances[4] of meningeal infection, 3 of which were apparently primary, without any point of entry that could be found. Seven of these were reported from England and two from Canada. They all presented the usual symptoms and signs of meningitis; the onset was sudden and the fatal course of the disease very rapid. The diagnosis in every case was made by finding the anthrax bacilli in the bloody spinal fluid.

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[3] Am. Jour. Public Health, February, 1919, p. 114.

[4] Roscoe: Lancet, March 17, 1917, p. 407. Warren and Williamson: Jour. Royal Naval Med. Service, April, 1918, p. 212. Gilmour and Campbell: Canadian Med. Assn. Jour., February, 1918, p. 97.

The possibility of anthrax causing meningitis has received very little recognition in this country, possibly because anthrax has not been a common disease. It has been recognized in Europe, however, since 1874, when Wagner described the pathological changes in two cases that came to autopsy. More recently there has been a number of instances recorded, notably by Merkel, Czyhiarz, Risel, Ziemke, Babes, Fulci and Herzog.

The hemorrhagic character of the meningeal exudate and the blood-stained spinal fluid are emphasized by all these writers, and are characteristic of this type of meningitis. Herzog, after a histological study of the bloodvessels in three cases, explains this as being due to a necrosis in the muscular coats of the vessels which permits the elastica and intima to be protruded by pressure and eventually to rupture. The toxins of the microörganism is believed to be the cause of the necrosis.[5]

SUMMARY. 1. A new method of anthrax transmission from the use of the shaving-brush has been discovered during the War.

2. The hair used in the manufacture of the infected brushes came chiefly from China and Siberia, to a lesser extent from the Argentine and Chicago. The hair was either not disinfected at all or inadequately disinfected.

3. The isolation of the Bacillus anthracis from the shaving-brush is accomplished better by the inoculation of susceptible animals than by cultural methods.

4. Meningitis due to anthrax may occur without any apparent point of entry. The spinal fluid is always bloody and contains the anthrax bacilli in large numbers.

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[5] Czyhiarz: Wien. klin. Wchnschr., 1916, xxix, 768. Risel: Ztschr. f. Hyg. u. Infectionskrank., 1903, xlii, 381. Ziemke: München. med. Wchnschr., 1898, No. 20, p. 765. Babes: Romania Medicale, 10 Jahr., 401. Fulci: Histolog. u. histopath. Arbeiten über die Grosshirnrinde, 1913, Bd. vi, Heft II, p. 1. Herzog: Beiträge zur path. Anat. u. zur allg. Path., lx, 513.